Comparison of Quantitative and Qualitative Methods of E-commerce Websites Evaluation

Omar Husain, Faudziah Ahmad and Jamaiah Yahaya

***Abstract*—This research paper aims at comparing both quantitative and qualitative methods in evaluating web sites. The purpose is to identify the various methods and factors that have been used to perform the evaluation. Analysis in terms of popularity of methods and ranking of factors are presented. The research serves as an initial study to explore various measurements that have been found in past literatures. The result provides useful information to those who are doing research in this field and related areas.**

***Index Terms*— E-commerce, Quality, Quantitative analysis, evaluation**

I. INTRODUCTION

The increase in growth of information technology, web technology, and communications all over the world have resulted e-commerce to become one of the most famous business models. Many enterprises begin to take e-commerce websites construction in their strategic planning [1]. While the web technology transforms all business into information-based activities, many organizations moved away from the traditional way to electronic way to be competitive and sustainable [2], [3].

In general, e-commerce can be defined as a business process of selling and buying products, goods, and services through online communications [4]. In other words, e-commerce means exchanging goods and services on the Internet as on-line shopping [5], [6]. E-commerce is considered as one of the factors that changes the way payment is made. According to [5], E-Commerce allows organization to know about their customers, to tell them more about their services and build strong relationship between the customers and the organization.

A large number of e-commerce websites have been established by companies to enhance the reputation of their brand and provide good services to the customers.

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Omar Husain Tarawneh. Dept. of Information Technology, UUM College of Arts & Sciences, Universiti Utara Malaysia, 06010, Kedah, Malaysia, Phone: 6-012-6292150; e-mail:omar_traw@yahoo.com.
Faudziah Ahmad, Dept. of Information Technology, UUM College of Arts & Sciences, Universiti Utara Malaysia, 06010, Kedah, Malaysia, Phone: 604-9284787; e-mail: fudz@uum.edu.my.
Jamaiah Haji Yahaya, Dept. of Information Technology, UUM College of Arts & Sciences, Universiti Utara Malaysia, 06010, Kedah, Malaysia, Phone: 604-9284788; e-mail: jamaiah@uum.edu.my.

E-commerce is considered as an ideal way for organization to reach new customers, reach the global development [7]. The important of companies' websites have been recognized by many. According to [8] the web plays a main role in diverse application domains, such as business, education, industry, entertainment and there are concerns of quality development of web-application.

The quality of e-commerce websites is the most important factor that affects the evaluation of websites. This is because quality represents the sight of organization to keep it competitive, sustainable, and beneficial for customer loyalty. There are many characteristics controlling the quality of websites and each consists of sub characteristic and attributes.

Evaluation of websites is thus an important issue. The reasons are many websites have been found to be unsatisfactory by users. A large percent of websites are in accessible from the user view points and many have short lives. Moreover, many of websites fail to meet companies' objectives. There are concerns about ways in which web applications are developed and the degree of quality delivered. Thus evaluation of websites can benefit companies in providing a quality and sustainable sites. The study aims to compile the various methods of evaluation, investigate the availability of quantitative and qualitative methods, and identify factors used in evaluating websites.

II. REVIEW OF PAST LITERATURES

There are many approaches to evaluate websites. In general, two approaches are widely known: quantitative and qualitative. In this paper, the quantitative and qualitative approach are studied and discussed.

A. *Quantitative Methods*

It has been found that several quantitative methods have been used in evaluating e-commerce websites. [9] and [10] used Quality Evaluation Method (QEM) to measure the functionality (global search, navigability and content relevancy), usability (site map, addresses directory), efficiency and site reliability of websites. The method was also used by [2] to evaluate product quality.

Another method known as Analytic Hierarchy Process (AHP), developed first by Satty in 1971 was used to solve the scarce resources allocation and planning needs for the military. AHP later had become one of the most widely used tools for making decisions based on multi criteria. Grey analysis

method (GA) was used to measure the distance between the set of every evaluation object's scores and the set of the best score of each criterion, and choose the object whose distance is the shortest to be the best website. It found that this method gave near value of evaluation [11], [12].

Another important method was Data Envelopment Analysis (DEA). This method was used to evaluate multi-criterion problems and improve the efficiencies. According to [6], DEA is a powerful quantitative, analytical method for measuring and evaluating performance.

In terms of measuring websites effectiveness, [2] developed a method known as Web Assessment Index (WAI) and has been used by [13] for evaluation.

Websites have also been evaluated based on customer satisfaction. Among the methods are Fuzzy Technique for Order Preference by Similarity (FTOPSIS) developed by [14] and Depth, an approach that performed scenario-based heuristic usability evaluation for e-commerce sites [15], [16]. The Microsoft Usability Guidelines (MUG) was another method used to evaluate the website usability. MUG comprised of five categories: content, ease of use, promotion, made-for-the-medium and emotion [17].

Other methods of websites evaluation were Eye Tracking (ET), Original Web Assessment (OWA) and Web Assessment method (WAM). ET used user's eye movements as the basis for analysis [18]. OWA used a set of criteria to evaluate the quality and success of existing ecommerce applications. The method focused on three areas namely customer perspective, success in implementing the offer of products, and how services are considered with reference to the specific features of the electronic medium. WAM, on the other hand, examined three classic transaction phases of electronic markets: information, agreement and settlement [19].

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B. Qualitative Methods

In terms of qualitative methods several methods have been found. Zadeh initiated the fuzzy set theory and Bellman presented some applications of fuzzy theories to the various decision-making processes in a fuzzy environment [13]. Fuzzy theory is widely applicable in information gathering, modeling, analysis, optimization, control, decision making and supervision. Fuzzy is used in support of linguistic variables and there is uncertainness in the problem.

The Extended Web Assessment Method (EWAM) was built based on WAM, Technology and Acceptance Model and several alternative approaches. Fuzzy analytic hierarchy process (FAHP) approach was used to evaluate e-commerce websites based on vagueness and uncertainty of judgment [3].

However, most researchers used common qualitative method such as interviews [2], [20] and case study as in [4] - [8], [21] and questionnaire [1], [3] to collect data.

III. ANALYSIS

The various methods identified from past literatures are compiled and grouped into two categories quantitative and qualitative. The methods are tabulated and presented in Table I and Table II (see Appendix).

The characteristics of the evaluation methods are compiled and listed. Some of the characteristics can be grouped together. Examples are customer satisfaction and usability. From the list of characteristics, six categories are identified; usability, functionality, reliability, efficiency, maintainability, and portability. These categories are known as measurements of quality. Fig. 1 shows the representation of characteristics and relation with quality.

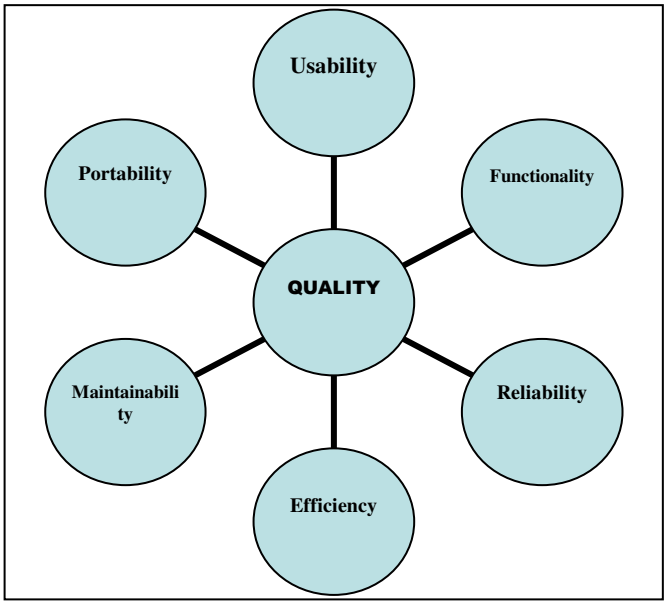

Fig. 1. The characteristics that effect of websites quality.

In order to obtain the popularity of measurements, the occurrences of measurements found in past literatures are calculated and tabulated in Table III and Table IV (see Appendix).

The occurrences are then calculated in terms of percentages:

$$OccurPercent = (TOccur / RS) * 100$$

where:

OccurPercent is percentage of occurrences (%)
TOccur is the total number of occurrences
RS is the total number of researches

Table V shows the results. For quantitative methods, usability occurs 89% while functionality occurs 42%. Reliability, efficiency, maintainability, and portability occur 36%, 36%, 5%, and 11% respectively.

The percentages of occurrences of measurements for qualitative methods are 95% (usability), 35% (functionality), 25% (reliability), 10% (efficiency), 20% (maintainability) and 10% (portability). The percentages of occurrences obtained were then tabulated in order of the highest value to the least value.

Based on Table V, it can be seen that usability is the most popular or common measurement used for websites evaluation in quantitative and qualitative methods. Next most common measurement for both methods was functionality. Reliability and efficiency is the third most popularity measurement for quantitative methods and maintainability for qualitative methods.

The least popular measurement for quantitative methods is maintainability. However, efficiency and portability are found to be the least popular method for qualitative methods. The reasons for the popularity of the measurements have not been discussed in this paper. This is due to time constraint and is still in the process of collecting supporting materials.

TABLE V
COMPARISON OF PERCENTAGES OF OCCURRENCES

Characteristics	OccurPercent (Quantitative Method)	OccurPercent (Qualitative Method)
Usability	89%	95%
Functionality	42%	35%
Reliability	36%	25%
Efficiency	36%	10%
Maintainability	5%	20%
Portability	11%	10%

In terms of best evaluation method, it is difficult to pin point which is the best, quantitative or qualitative? This is because each has its advantages and disadvantages and researchers are experts in their own way and chose to evaluate based on their own expertise in analysis. In terms of measurements, which of the six categories is the best measurement? It is definitely an ideal if a comprehensive measurement is incorporated in an evaluation. However, using all measurements is a complex process and may be unachievable due to limitations in terms of resources. Thus, the use of several measurements is recommended.

IV. CONCLUSION

The study compiles various methods of evaluation. and categorizes them into quantitative and qualitative methods. Popularity of factors used for measurements have been investigated based on occurrences. It has been found the usability is the most commonly used measurement for both quantitative and qualitative methods while portability was not commonly used. The uses of all measurements are not recommended due to limitations in terms of resources. The reasons for why some measurements are commonly used or otherwise and what are the most effective measurements will be investigated in future work.

APPENDIX

TABLE I
PAST RESERCH ON QUANTITATIVE METHODS

Research number	Author (year)	Method	Characteristics studied	Remark
1	Francisco Javier Miranda, Rosa Cortés and Cristina Barriuso (2006)	Web Assessment Index (WAI)	Accessibility, speed, navigability, site content.	Poor results if characteristics of WAI are absent.
2	Miranda, Cortés and Barriuso (2006)		Functionality, usability, efficiency, reliability.	High flexibility of the WAI and WAI could have detected the weaknesses of web Pages assessed.
3	Francisco Javier Miranda, Rosa Cortés and Cristina Barriuso (2006)	Quality Evaluation Method (QEM)	functionality, usability, efficiency, reliability	Excessive number of attributes employed raises some subtle problems of computational nature
4	Luis Olsina, Gustavo Rossi (2001)		user perspectives navigation, interface, reliability, usability functionality, efficiency	Found that many e-book store suffer if characteristics studied are absent
5	Luis Olsina , Gustavo Rossi (2000)		usability, functionality, reliability, and efficiency	The method used are more efficient and powerful
6	A. K. Abd El-Aleem, W. F. Abd El-wahed, N. A. Ismail, F. A. Torkey (2005)	Data envelopment analysis (DEA)	design, usability and performance	Found that are four sites efficient and five inefficient
7	Vaclav Petricek, Tobias Escher, Ingemar J. Cox, Helen Margetts (2006)	Manually analysis	internationally, modality link structure of e-government sites, internal structure, external connectivity	The US and Canada emerge as the most internally connected and navigable sites in relation to their size.
8	Mehdi Fasanghari, Navid Gholamy , S. Kamal Chaharsooghi, Shohre Qadami , Mohamad Soltani Delgosha(2008)	customer satisfaction evaluation method	customer satisfaction.	The evaluation method shows good results and can be used as a good tool for evaluation.
9	Peide Liu, Ruishan Hu (2008)	Synthesis evaluation method, OWA and LOWA operator	service, information, technology, credit and security.	Identified the best e-commerce website in terms of product and services. Facilitate identifying the strength and potential websites so that sensible decisions can be made.
10	Chu Fang-fang, LI Yi-jun(2005)	Grey Analysis (GA)	usability, reliability, and cost	The order from the best websites to the worst websites is presented.
11	Chu Fang-fang, LI Yi-jun (2005)	Concordance Analysis (CA)	usability, reliability, and cost	The priority index and the non-priority index of websites are presented.
12	Chang Jinling, Xia Guoping (2005)		satisfaction, dissatisfaction.	A simple evaluation model which is each practical and programmable.
13	M. Sartzetaki, Y. Psaromiligkos, S. Retalis, P. Avgeriou (2003)	Depth (evaluation approach based on DEsign PaTterns & Heuristic criteria)	usability of websites.	Identifies that easy-to-measure are important.
14	Alistair Sutcliffe (2002)	Heuristic evaluation Methods	attractiveness and usability, design.	Heuristics should not be used for subjective rating style judgment.

Research number	Author (year)	Method	Characteristics studied	Remark
15	Chang Jinling, Guan Huan, (2007)	Microsoft Usability Guidelines,	content, ease of use, promotion, made-for-the-medium and emotion.	All websites showed great importance to "Content". Other attribute differ from site to another.
16	Ekaterini Tzanidou, Shailey Minocha, Marian Petre, (2005)	Eye Tracking method	design of website.	Users rarely looked at the menu bar Their scan paths focused mainly on the middle left side of the screen.
17	Yi-wen Liu*, Young-jik Kwon, Byeong-do Kang (2007)	Fuzzy logic	website basic technique, web page design:, website information/content, website function/service.	Presented the applicability of the proposed approach.
18	Adriano Bessa Albuquerque, Arnaldo Dias Belchior (2001)		conceptual reliability, satisfactorily, reliability of the representation.	All factors are found to be important. However, Security and Integrity obtained the best score.
19	Chu Fang-fang, LI Yi-jun, (2005)		usability, reliability, and cost	Presented the ranking of websites from best to worst. However could not know the absolute value of each website.
20	Petra Schubert, Uwe Leimstoll, (2001)	original Web Assessment (WA) method	ease of use, usefulness, trust category	Most web sites were far from fully meeting user expectations

TABLE II
PAST RESEARCHES ON QUALITATIVE METHODS

Research number	Author (year)	Method	Characteristics studied	Remark
1	Adriano Bessa Albuquerque, Arnaldo Dias Belchior (2001)	Questionnaire	usability, conceptual reliability, presentation reliability.	All factors obtained a good final evaluation, however, security and integrity obtained the best score.
2	Yi-wen Liu*, Young-jik Kwon, Byeong-do Kang (2007)		technique, design, information, services.	The approach is applicable as an evaluation technique for ecommerce websites.
3	Mehdi Fasanghari and Farzad Habibipour Roudsari (2008)		customer satisfaction and expectation.	Evaluation method creates suitable results and the evaluation could be done as well as possible.
4	Mehdi Fasanghari, Navid Gholamy ,S.Kamal Chaharsooghi, Shohre Qadami ,Mohamad Soltani delgosha (2008)		satisfaction degree.	The evaluation method creates suitable results, and the degree of satisfaction and expectation are closely related.
5	Chu Fang-fang, Li Yi-jun (2005)		usability, reliability of the websites, the cost of using the websites.	The order of websites from best to worst is presented.
6	M. Sartzetaki, Y. Psaromiligkos, S. Retalis, P. Avgeriou (2003)		existence, user satisfaction, easy of use, and/or usefulness, functionality, usability.	Provide information on quantitative and qualitative evaluations.
7	Adriano Bessa Albuquerque, Amaldo Dias Belchior (2002)		usability, conceptual reliability, representation reliability.	Evaluate each sub factors of quality. The sub factors are then rated according to its importance. The domain used was e-commerce website application.
8	Alistair Sutcliffe (2002)		attractiveness and usability, design.	Capture users' ratings for the variables used. Found that designers have little guidance for creating attractive user interfaces.
9	Chang Jinling, Guan Huan (2007)		content, ease of use, promotion, made-for-the-medium and emotion.	Investigate the importance of variables used from user point of view. Found the rating was different from one user to another.
10	Petra Schubert, Walter Dettling, (2002)		performance.	Comparison of the performances of two companies (SwissAir and Amazon.com) based on offers given by each company.
11	Yi-wen Liu, Young-jik Kwon, Byeong-do Kang	Interview	website basic technique, web page design:, website	Case study which shows that judgments on the website characteristics of all decision makers are consistent and

	(2007)		information/content, website function/service.	can be accepted.
12	Ekaterini Tzanidou, Shailey Minocha, Marian Petre, (2005)		expectations and preferences from e-commerce sites.	Investigate how the users' previous experiences with internet / e-commerce websites and their preferences and expectations of e-commerce-interaction influence their eye movement.
13	Petra Schubert, Walter Dettling (2002)	Extended Web Assessment Method (EWAM)	electronic markets and transaction phases, information technology / media-inherent characteristics, performance marketing.	Used EWAM together with TAM to evaluate websites quantitatively and qualitatively.
14	Alistair Sutcliffe (2002)	Observation	users' errors when navigating websites; expert style.	Found that most of users' make errors when navigating websites
15	Mehdi Fasanghari, Navid Gholamy, S. Kamal Chaharsooghi, Shohre Qadami, Mohamad Soltani Delgosha (2008)		customer satisfaction. attractiveness	Most of observed user problems could be identified by expert inspection using heuristics. From the case study it was found that only two heuristics attracted adverse comments: judgment of symmetry and depth of field.
16	Adriano Bessa Albuquerque, Amaldo Dias Belchior (2002)		usability, conceptual reliability, representation reliability.	Investigate the appropriateness of factors used for measuring websites.
17	Mehdi Fasanghari, Navid Gholamy, S. Kamal Chaharsooghi, Shohre Qadami, Mohamad Soltani Delgosha(2008)		product, service, network system, payment	Found product, service, network system, and payment could be used for evaluation of websites.

TABLE III
TOTAL OCCURRENCES FOR QUANTITATIVE METHODS

Categories of measurement	Research number (RS)																				TOccur
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Usability	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	19
Functionality	*	*	*	*	*	*			*					*			*				9
Reliability		*	*	*	*					*	*							*	*		8
Efficiency	*	*	*	*	*	*	*										*		*		9
Maintainability										*	*										2
Portability	*			*			*														3

TABLE IV
TOTAL OCCURRENCES FOR QUALITATIVE METHODS

Categories of measurement	Research number (RS)																	TOccur
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Usability	*	*	*	*	*	*	*	*	*		*	*			*	*	*	15
Functionality		*				*		*	*		*						*	6
Reliability	*				*		*									*		4
Efficiency		*			*				*	*			*				*	6
Maintainability														*				1
Portability													*	*				2

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Omar Husain Tarawneh is a PHD candidate at Faculty of IT, College of Arts and Sciences, Universiti Utara Malaysia (UUM), Sintok, Kedah, Malaysia since 2008. His previous experience includes teaching at college in Jordan for 5 years. He has B.Sc in computer science (2003) from Mutah University Jordan and MSc in Information Technology (2006) from Arab Academy for Banking and Financial Sciences (AABFS).

Dr. Faudziah Ahmad received the B.Sc Computer Information Systems in 1987, Postgraduate Diploma in Computer Science in 1990 and MSc Management in 1994. In 2006 she received her PhD (System Management and Science) and currently is a senior lecturer in University Utara Malaysia. Her research interest includes data mining, intelligent system, text mining, and performance evaluation.

Dr. Jamaiah Haji Yahaya is a senior lecturer at College of Arts and Sciences, Northern University of Malaysia (UUM), Sintok, Kedah, Malaysia since 2000. Prior that she worked as a system analyst at University of Science Malaysia, Penang. Her bachelor degree was Bachelor of Science in Computer Science and Mathematics from University of Wisconsin-La Crosse, USA (1986), Master of Science in Information System from University of Leeds, UK (1998), and PhD in Computer Science from National University of Malaysia (UKM) (2007). Her PhD thesis is the development of software certification model based on product quality approach. Later, she continued her PhD research as a post doctoral fellow in UKM (2008). Her research interests are software certification, software quality and software management.